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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/632,913	08/04/2003	Takanori Matsuda	03500.017467.	4925

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EXAMINER	
DOUGHERTY, THOMAS M	
ART UNIT	**PAPER NUMBER**
2834	

DATE MAILED: 07/06/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/632,913	MATSUDA ET AL.	
	Examiner	Art Unit	
	Thomas M. Dougherty	2834	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *08 April 2005*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-14* is/are pending in the application.

4a) Of the above claim(s) *14* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-13* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *04 August 2003* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

Response to Arguments

Applicant's arguments, filed 4/8/05, with respect to the election/restriction requirement have been fully considered but are not persuasive for the reasons cited in the election/restriction requirement.

Claim Objections

Claim 3 is objected to because of the following informalities: the claim requires a period at the end of the claim to complete the sentence. Appropriate correction is required.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 1, 2 and 8 are rejected under 35 U.S.C. 102(e) as being anticipated by Ramesh (US 6,781,176). Ramesh shows (fig. 5) an actuator comprising: a laminated structure having a vibration plate (62, 70, 72), a lower electrode (64), a piezoelectric element (66), and an upper electrode (68) laminated sequentially on a basic element, wherein at least said lower electrode or said two electrodes is a thin oxide film of La-doped single oriented crystal or monocrystal containing Sr and Ti. See col. 6, ll. 45-61.

The piezoelectric element (66) is a thin oxide piezo-electrostrictive film of single orientated crystal or monocrystal. See col. 6, ll. 56-57.

The piezoelectric element (66) is a thin oxide piezo-electrostrictive film of single orientated crystal or monocrystal (as noted) containing Pb, and at least either one of Zr, Ti, Ni, Nb, Mg, Zn, and Sc. Note that the piezoelectric material is PZT.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claim 3 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ramesh (US 6,781,176) in view of Nakajima et al. (US 5,214,738). Given the invention of Ramesh as noted above he doesn't discuss the La doping concentration in the electrode of thin oxide film of single orientated crystal or monocrystal as being within a range of 0.05 atm% to 10 atm%.

Nakajima et al. notes (claim 1) an oxide electrode with Lanthanum doping ranging from .0005 to .01 atm, overlaping the range of 0.05 atm% to 10 atm%.

Nakajima et al. don't show a vibration plate or piezoelectric element.

It would have been obvious to one having ordinary skill in the art to employ the range of Lanthanum doping shown by Nakajima et al. in the device of Ramesh since the invention of Nakajima et al. teaches that this structure "exhibits a resistance variation in

a transition region of from 1 to 10 orders of magnitude ...", thereby lengthening the life time of the structure.

Additionally, it would have been obvious to one having ordinary skill in the art to have an La doping concentration in the electrode of thin oxide film of single orientated crystal or monocrystal as being within a range of 0.05 atm% to 10 atm%, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. In re Aller, 105 USPQ 233.

Claim 4 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ramesh (US 6,781,176) in view of Zuha et al. (US 6,060,735). Given the invention of Ramesh as noted above he doesn't discuss the lattice constant of the electrode of thin oxide film of single orientated crystal or monocrystal being within a range of 3.905 Angstroms to 4.030 Angstroms.

Izuha et al. teach (see ABSTRACT) setting a lattice constant of a lower electrode as being matched to that of a dielectric thin film at an interface so as to achieve a desired lessening of leak current thereby reducing the chance of dielectric breakdown.

Izuha et al. further show a piezoelectric actuator type of device (se col. 4, ll. 46-57), but they don't note single crystal or monocrystal elements of the invention.

It would have been obvious to employ the teaching of Izuha et al. regarding the setting of the lattice constant of Ramesh, and at that, between the range of 3.905 Angstroms to 4.030 Angstroms, since it has been held that where the general conditions

of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. In re Aller, 105 USPQ 233.

Claims 5 and 11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ramesh (US 6,781,176) in view of Ramesh (US 5,519,235). Given the invention of Ramesh as noted above he doesn't discuss the thickness of his electrode of thin oxide film of single orientated crystal or monocrystal being within a range of 50 nm to 5,000nm. He doesn't note the thickness of his piezo-electrostrictive film being 500 nm or more and less than 10 micrometers.

In the second cited Ramesh reference, he shows a similar invention with an electrode thickness of 100 nm. See col. 2, ll. 60-61. He further notes his piezoelectric layer being on the order of 500 nm, see col. 2, l. 64.

It would have been obvious arrange an electrode thickness in the device of Ramesh between 50 nm and 5,000 nm, and a piezo-electrostrictive film thickness between 500 nm to 10 micrometers, such as the second Ramesh reference shows, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. In re Aller, 105 USPQ 233.

Additionally, these thicknesses are within the MEMS structure dimensions, which is one of the intended designs of the first Ramesh reference. See col. 8, ll. 41-45.

Claims 6, 7 and 9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ramesh (US 6,781,176) in view of Jia et al. (US 6,743,292). Given the invention of Ramesh as noted above, he doesn't note the crystal orientation of the electrode of

thin oxide film of single orientated crystal or monocrystal being either one of (010), (101), (110), and (111) or note a crystal orientation ratio of 95% or a crystal orientation ratio of the thin oxide piezo-electrostrictive film of single orientated crystal or monocrystal being 90% or more..

Jia et al. note crystal the crystal orientation of the electrode of thin oxide film of single orientated crystal or monocrystal being either one of (010), (101), (110), and (111). Their electrode of thin oxide film contains lanthanum. See col. 5, l. 10.

Jia et al. don't show a piezoelectric actuator or note a crystal orientation ratio.

It would have been obvious to one having ordinary skill in the art to employ a crystal orientation of an electrode of thin oxide film of single orientated crystal or monocrystal of one of (010), (101), (110) and (111), this results in improved electric/dielectric properties of piezoelectric elements as noted at col. 2, ll. 32-35.

Regarding the said ratio, it would have been obvious to one having a crystal orientation ratio for the thin oxide film electrode of 95% or more, and having a crystal orientation ratio of the thin oxide piezo-electrostrictive film of single orientated crystal or monocrystal being 90% or more, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. In re Aller, 105 USPQ 233.

Claim 10 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ramesh (US 6,781,176) in view of Chiang et al. (US 6,231,779). Given the invention of Ramesh as noted above, he doesn't note a rhombohedral or tetragonal piezoelectric crystal.

Chiang et al. note at col. 11, ll. 42-60, that tetragonal piezoelectric crystal shapes have useful piezoelectric properties and that rhombohedral piezoelectric crystal shapes in a piezoelectric actuator result in a low hysteresis. See col. 16, ll. 58-60.

Chiang et al. don't note lanthanum doping in thin oxide electrodes.

It would have been obvious to one having ordinary skill in the art to employ a rhombohedral or tetragonal crystal in their device in order to take advantage of the low hysteresis and other use piezoelectric properties as noted by Chiang et al.

Claims 12 and 13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ramesh (US 6,781,176) in view Higuchi et al. (US 6,739,703). Given the invention of Ramesh as noted above, he doesn't show a liquid discharge head provided with his invention.

Higuchi shows (fig. 3) a liquid discharge head having an actuator (40), and the pressure chamber (21) formed with an opening portion on a part thereof (the top), and communicated with liquid discharge port (11), wherein said actuator is provided on (as noted, it sits atop) said pressure chamber (21) so as to close said opening portion. Note that the top of the structure, sits on the pressure chamber substrate (20) thereby closing it. This closure obviously includes the components (31, 32) which receive the motion caused by activation of the actuator (40).

Higuchi shows (fig. 3) a liquid discharge head (see TITLE) provided with a main body portion having the pressure chamber (21) communicated with liquid discharge port (11), and an actuator(40) provided on said main body portion corresponding to said pressure chamber.

Higuchi doesn't show an actuator with at least a lower electrode being a thin oxide film doped with La of single orientated crystal or monocrystal containing Sr and Ti.

It would have been obvious to one having ordinary skill in the art to employ as an actuator in the device of Higuchi, at the time his invention was made, a thin oxide film doped with La of single orientated crystal or monocrystal containing Sr and Ti, such as is shown by Ramesh, in order to take advantage of the discovery that such a design prevents or lessens fatigue in the component as Ramesh notes at col. 3, line 35.

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. The remaining prior art cited reads on aspects of the claimed invention. Desu ('567) teaches at col. 4, ll. 3-6 that Lanthanum is a known dopant for reducing "the fatigue rate of PZT thin films". Yamamoto et al. ('715) teach use of tetragonal or rhombohedral crystals in piezoelectric actuators. Suzuki et al. ('898) teach manipulation of the lattice structure in their dielectric thin film invention. See their ABSTRACT.

Direct inquiry to Examiner Dougherty at (571) 272-2022.

tmd

tmd

May 12, 2005

Thomas M. Dougherty

TOM DOUGHERTY
PRIMARY EXAMINER